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CANADIANA

MAY - 7 1992

ENERGY $AVER$

"... For Business and Industry".
VOLUME 3 / NUMBER 4

CONTROL YOUR RAMP HEATING SYSTEM AND SAVE

The Facts ...

A simple device that controls parking ramp heaters during snowfall can help save energy dollars.

Keeping sidewalks, driveways and parking ramps safe and free of snow is a problem for most Alberta building operators. In solving the problem, many heating systems are left on longer than required – often all winter – resulting in unnecessarily high energy consumption. Using a snow-sensing device to control heaters can reduce electricity use because heaters operate only when it's snowing.

A snow sensor is equipped with an air temperature sensor and detects any precipitation falling at 38°F (3°C) and lower as snow. The sensor's heating element melts the snow, allowing a small current to flow between the sensor areas which turns on the ramp or driveway heating system. A timer can be set to allow for up to five hours of extra heating after the snow stops.

In Alberta, there are two types of snow sensors available. One type is connected to a control panel that operates up to 7000 watts of heating load. Otherwise, the control panel is connected to the coils of a relay which can control larger loads. Up to six sensors can be plugged into the panel including: snow, frost, gutter (prevents icing) and slab temperature. The snow sensor module should be mounted in a completely exposed area (i.e. not protected by roof overhang, etc.) and can be up to 2000 feet from the control panel. This type of sensor costs about $1000 (snow sensor and control panel).

The other type of sensor is less expensive, about $200, and is wired directly into the coil of a relay. It operates the same as the other type, except the timer is not adjustable and is set at five hours after it has stopped snowing. This type can be cost-effective for smaller buildings and specific uses such as sidewalks and wheelchair ramps.

Manual operation of driveway and ramp heating systems is feasible but is not as reliable or convenient as automatic control. For example, if it started snowing during the night or on a weekend, building staff would be too late to activate the heating system when arriving for work the next morning. If it started snowing before staff left for home, the system would remain on until morning regardless of the amount.

Because of these problems, many building operators leave the ramp heating system on all winter, resulting in excessive electrical consumption. The use of a timer can help reduce the length of time a heating system is activated. However, estimating how long it takes to melt the snow can be difficult.

Loading bay ramp at City of Edmonton facility

For rapid snow melting, the temperture of the concrete slab must be higher than the melting point, usually above 42°F (5°C). If a timer is used, it should be combined with a thermostat that cycles the heater on and off to maintain a slab temperature of about 45°F (7°C). This will further reduce the amount of electrical energy used. A thermostat can also be used with a snow sensor.

Using a snow sensor to control ramp and driveway heaters reduces the amount of electrical energy consumed but does not necessarily lower the demand reading. Electrical costs are based on both energy (consumption) and demand charges. (Energy is the total amount of electricity used during the billing period. Demand is the maximum amount of electricity used at any single time during the period.) The electrical costs for some Alberta buildings are based on an energy-oriented rate structure (with demand-related blocks) while others are based on a demand-oriented rate structure. For building owners and operators whose rate structure is energy-based, installing a snow-sensing device will be more cost-effective than for those billed on a demand-oriented rate structure.

When ramps are heated with glycol, both natural gas and electrical cost savings are possible by using a snow sensor. Hot water passed through a converter heats the glycol. Electrical energy operates the system's circulating pump. Snow sensors can also be used on infra red/natural gas ramp heating systems. In this case, significant savings in natural gas costs can be attained.

The Application …

The Westwood Mobile Equipment Services facility, owned and operated by the City of Edmonton, houses an office tower, warehouse, vehicle service bays and fabrication shop. This facility was built in 1981 and has a floor area of some 167 000 square feet (15 510 square metres).

A large heated ramp on the south side of the building services five loading docks and covers an area of 3600 square feet (330 square metres). Glycol coils (25 mm diameter) are buried between 40 and 90 mm below the ramp surface. Hot water from the main boiler system, with a measured combustion efficiency of 60 per cent, is passed through a converter to heat the glycol.

In the spring of 1989, Alberta's Energy Bus audit staff visited the Westwood facility to assess its energy use and the potential for energy cost savings. The audit team suggested that ramp heating energy use and costs could be reduced by installing a snow-sensing controller.

Prior to the audit, the ramp heating system was turned on during the first snowfall and left on for the entire winter – about five months. The system was equipped with an automatic pad temperature control that activated the glycol circulating pump. Instructions on the control read "set pad temperature to 2°C (36°F)". At the time of the audit, the temperature control was set considerably higher, 80°C (176°F), and the glycol circulating pump control switch was set in the "hand" position rather than the "auto" position.

Because the automatic control was being manually overridden, the ramp was heated continuously during the winter months, costing the City of Edmonton $2965 per year for glycol heating and electrical pumping costs.

In November 1989, Len Rivard, supervisor of the servicing section, ordered an automatic snow sensor and arranged to have it installed by mid-December. Potential dollar savings using the snow-sensing device were calculated – about $2165 per year (off 75 per cent of the time). Total installment cost – $2430. This included:

- Control panel and snow sensor
- labor cost installation
- building roof modifications to accommodate the new equipment
- 20 feet of conduit and wiring
- relay

The payback period was determined by dividing the installation cost by savings $2430/2165 = 1.1 years or about one winter season.

In some applications, manual manipulations may be necessary to successfully melt the snow. This is due to other problems not related to the control itself. For example, with Westwood Mobile Equipment Services facility; Real Demers, maintenance repair, said that in anticipation of a major snow storm he would manually override the control until all snow and ice had melted. Demers stated the reason for this action was to allow the ramp to "catch up" due to the undersized heat exchanger.

The snow sensor allows Westwood to keep the ramp heated while saving considerable energy and money. Rivard said there are four or five other City of Edmonton buildings where snow sensors are working successfully.

The Bottom Line …

For operators of office buildings, hotels and apartments, installing a simple, snow-sensing device can lead to big annual energy cost savings.

The accompanying graphs (Figures 1 and 2) help to illustrate the potential annual savings that can be achieved with a snow sensor. The savings are based on a 1000 square foot (93 m^2) ramp that is operated for six months of the year (4368 hours). Figure 1 applies to ramps that are electrically heated. Figure 2 applies to ramps that are heated with glycol or infrared systems (natural gas). Savings will vary depending on the lowest electrical energy cost block that is applicable and the applicable natural gas cost.

To calculate potential savings, use Figure 1 for a ramp that is electrically heated. Several factors must be known: the ramp area and the lowest electrical energy cost block. By using a snow sensor, the ramp will be off about 65 per cent of the time or 2840 hours, based on typical annual snowfall patterns. This means that for a six-month period, ramp heaters will operate about 1528 hours (4368 - 2840).

To use the graph, locate the electrical energy cost block on the horizontal that is nearest to your lowest cost block and read up to the diagonal line and across to the left for the electrical cost savings. If your ramp is greater than or less than 1000 square feet, divide the area of your ramp by 1000 and multiply the savings (from the graph) by this amount. The example on the graph shows the annual savings ($4260) for a facility whose lowest electrical energy cost block is $0.03 per kilowatt hour (kW.h).

If your ramp is heated with natural gas, use Figure 2 and follow the procedure for Figure 1. In this case, the natural gas cost must be known. The graph is based on a 1000 square foot ramp and an average of 75 per cent efficiency for natural gas. (Infrared system are 100 per cent efficient, so the savings will be slightly lower). The example on the graph shows the annual savings ($1330) for a facility whose natural gas cost is $2.00 per giagjoule (GJ).

FIGURE 1

Electrical Cost Savings
(From Reduced Ramp Heating "ON" Time)

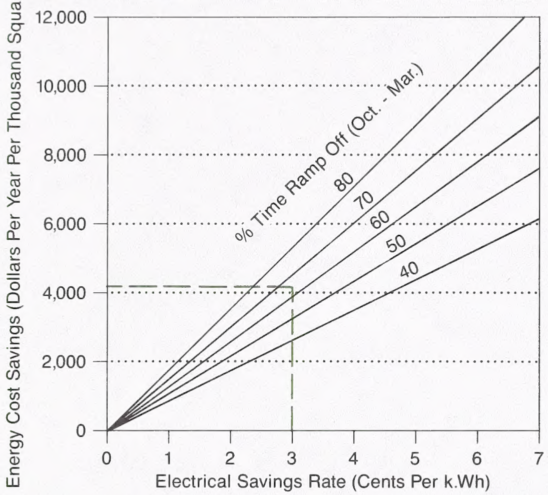
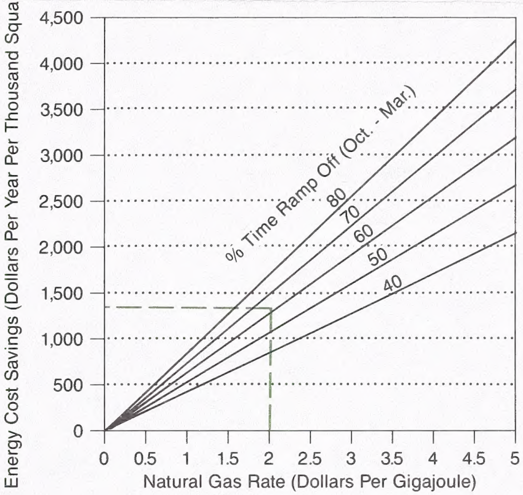


FIGURE 2

Natural Gas Cost Savings
(From Reduced Ramp Heating "ON" Time)



SECTOR REVIEW

Municipal Facilities Energy Use

Energy use varies widely, depending on the type of building and the activities in that building. The variety of energy use has become evident following Energy Bus audits of almost every type of facility in Alberta.

An energy audit determines how energy is being used and how much it costs in each area. Energy conservation measures are identified which may result in energy cost savings. On average, the Energy Bus has identified a potential reduction in energy costs of about 20 per cent.

Figure 3 shows energy use in kilowatt hours per square foot per year for electricity and natural gas in the 3 municipal service facilities with ramp heating equipment visited by Alberta's Energy Bus.

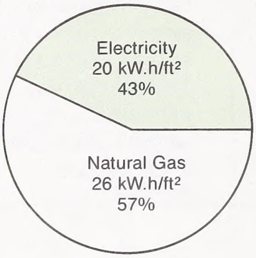
Figure 3 also compares the use of energy and its associated costs in these service facilities. In Alberta, natural gas is the least expensive energy source. The average price of a unit of electrical energy is four to five times more than the equivalent unit of natural gas. Therefore, when analyzing energy use, associated energy costs must be considered.

Figure 4, shows how electrical and natural gas energy is used in municipal service facilities.

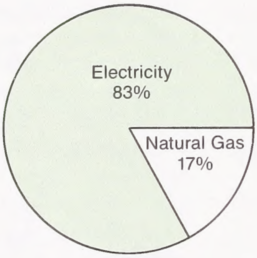
During the winter, vehicle ramp and sidewalk heaters are necessary to melt snow and ice to provide safe conditions for vehicle and pedestrian traffic. Energy Bus audits have identified considerable cost-saving potential by installing controls to turn the heaters on and off when required and obtain the benefits without excessive cost.

FIGURE 3

Energy Use and Cost in Municipal Service Facilities



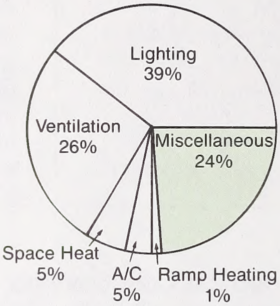
Energy Use



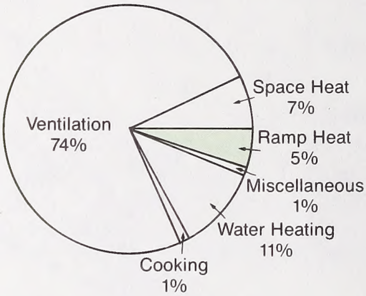
Energy Cost

FIGURE 4

Energy Usage Breakdown in Municipal Service Facilities



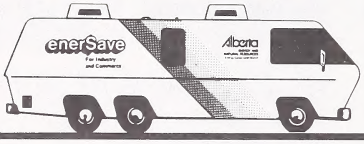
Electricity



Natural Gas

FOR MORE INFORMATION

The article *Control Your Heating System and Save* was researched by Doug Brough, the Sector Review completed by Brian Weir. For detailed information on energy cost-saving calculations and the energy audit database, contact the Technical Services Section of the Energy Efficiency Branch: Phone 427-5200 (collect).



ENERGY $AVER$

Energy $aver$ is a series of fact sheets about energy efficiency measures that have wide application in Alberta. Each issue highlights a different technology and its successful use in the province. The Sector Review summarizes energy use patterns of different facilities that have used Alberta's Energy Bus audit service. Comments, questions, and suggestions are welcome.

Write or phone (collect) to be placed on the mailing list. You may also receive back issues or arrange for an Energy Bus audit (conducted at no charge).

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Printed in Canada
Pub. No. 1/249 1991
ISBN 0-86499-5660

Printed on Recycled Paper ♻

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